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ABSTRACT

This guide is intended to assist the organization of studies dealing with the behavior of human societies and their institutions in relation to their environments. Emphasis is on contemporary industrial and postindustrial society as it expresses its environmental relationships through action defined by policies, laws, and administrative arrangements. The content and organization is essentially multidisciplinary. Twelve subtopics are organized around the following four major areas: (1) basic environmental concepts--introduction and background; (2) environment as a policy issue--origins, characteristics, and implications; (3) reconciling natural and technical systems--objectives, approaches, and processes; and (4) problems of policy implementation--economic, juridical, and institutional. Each of the subtopics is keyed to references in the comprehensive bibliographies. Subtopics are defined and described by an abstract. Bibliographic references to articles and books comprise the bulk of the document. For each topic, a set of 10 organizing questions has been provided to enable the student to estimate his comprehension of the subject. (Author/JR)

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ENVIRONMENTAL POLICY, LAW AND ADMINISTRATION
A GUIDE TO ADVANCED STUDY

A guide to study of the institutional arrangements and political processes by which human society manages natural systems and resources, and attempts to reconcile its demands upon the natural world with the ability of nature to sustain living systems, to support technical systems, and to provide specified levels of environmental quality with continuing economy of human effort.

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FOREWORD

This guide is intended to assist the organization of studies dealing with the behavior of human societies and their institutions in relation to their environments. Emphasis is on contemporary industrial and postindustrial society as it expresses its environmental relationships through action defined by policies, laws, and administrative arrangements. Content and organization are essentially multidisciplinary and synthesizing. Bibliographical citations may therefore be classified in ways that are unfamiliar to specialists in the contributory fields of study.

The format of the Guide follows that previously developed at Indiana University for the study of science, technology, and public policy.[1] It undertakes to organize the field of inquiry on a broad topical basis and to subdivide each topic into subtopics which are keyed to references in comprehensive bibliographies. The Guide has been designed so that it may be adapted to differing emphases or to independent study outside the classroom.

Each of the twelve topics is defined and described by an abstract. Selected references are listed to bring to the attention of the student certain comprehensive or noteworthy contributions to the topic. These selections are not necessarily "definitive," however, in the sense that they are in every instance the "best" or "most important" writings on the subject. Opinions often differ as to what should be considered the indispensable writings on a particular topic. Moreover, items may be useful or even essential for a variety of reasons; an article of uncertain value for one purpose may be highly significant for another. An effort has been made to provide for a broad range of possible uses rather than to presume to identify the "most significant works." Specific aspects of each topic may be followed up through the use of a reference key. These reference citations, however, are limited to representative samples of a larger literature. They do not contain all of the materials in the bibliographies relating to any particular topical item. The user will need to peruse the bibliographies for a complete set of references to most topics in the outlines.

For each topic, a set of ten questions has been provided to enable the student to make some estimate of his comprehension of the subject. To the extent that the student understands the questions, he may be assumed to understand the topic. This comprehension may be more important than being able to answer all the questions, because many of them are intended to provoke thought or to point out issues, not necessarily to elicit definitive answers. And, in any event, valid answers must be preceded by a valid understanding of the questions.

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[1] Science, Technology, and Public Policy: A Guide to Advanced Study. Prepared by Lynton K. Caldwell and Toufiq A. Siddiqi. Bloomington: School of Public and Environmental Affairs, Indiana University, 1972.

Problems of Boundaries and Focus

Because the great majority of users are likely to be in the United States and Canada, the Guide has been weighted toward North American problems and policies. Nevertheless, the approach of the editors has been generic (or international) with respect to man-environment relationships. The ultimate boundaries of our concern are the human species and the biosphere.

One of the functions of this study guide is to help the student organize the subject matter from the viewpoint of public policy and action. It is difficult to cope intellectually with a subject matter in which a seemingly infinite number of components are dynamically interrelated. Accordingly, it is necessary to find some structure or set of ordered relationships by which the complex, comprehensive, interdisciplinary literature of environmental policy can be put into comprehensible form.

The organization of this guide represents the set of structured relationships by which the authors have conceptualized this field of study. It may, therefore, be helpful to the student to understand the reasoning that lies behind the organization, selection, and treatment of the particular topics. Two observations are needed with respect to focus, and several additional observations seem called for in relation to the content of the field of study, at least as covered in this publication.

The Focus is on Policy

Our subject matter is not ecology nor man-environment relationships per se. It is instead the processes by which human societies choose and shape their relationships to their environments. In a very broad sense, these processes are "political." They involve social choices, made characteristically through public institutions, governmental and nongovernmental (e.g., corporations, professional associations, universities, and international organizations). These choices reflect values and power relationships prevailing in societies. They also reflect changing social perceptions and behavior patterns and, to this extent, may illuminate the general course of social and political development.

Policy is not merely process; it involves the substance of issues and decisions. The circumstances and implications of decisions cannot be understood without reference to the problems at issue. On matters of environmental policy, understanding may involve inputs from a wide range of scientific and technical fields. This information is seldom organized for the convenience of the policy analyst or decision-maker. But it may be studied in relation to its significance and implications for environmental policy decisions. The scientific and technical literature cited in the topical bibliographies of this study guide is intended to be used in this way. The subject matter specialist would read this literature for one set of purposes, the student of policy would read it from a different perspective.

Our Concept of the Field of Study is the Integration of Technical and Natural Systems

Environmental relationships undefined and unstructured are intellectually unmanageable: the details, the interactions, and the dynamics are too numerous, too diverse, and too extensive in time, space, and subject matter. But this vast seemingly amorphous mass of data can be made manageable in a practical way if it can be organized in a manner that is consistent with actual relationships in the real world. Ordered complexity may be made comprehensible.

All matter is structured, and all living matter is structured and "programmed" in a behavioral if not teleological sense. The structuring of nature is systemic, not random. The emergence, survival, expansion, and decline of living species have been discovered to be inseparable from the environmental systems of which they are a part. Human society has devised technical systems by rearranging systems and substances evolved in nature and reprogramming their dynamics. This process of dynamic reorganization is a function of technology, and we see its results in agriculture, cities, mines, machines, medicine, and all other artifacts and institutions of human culture.

Since his emergence on Earth, man has coped individually and collectively with the hazards and opportunities of the primary natural environment. But with the advent of civilization, a secondary environment of technical systems was created to support increasing numbers and concentrations of people and increasingly artificial (managed or contrived) styles of life. These technical systems have been built from materials in the natural world, identified as "natural resources." This process of transformation of natural substances and environments into the materials, structures, and landscapes of civilization has hitherto largely been one of trial and error. The achievements of civilization reflect the successes, but there have also been errors. Many of these errors, and some among the more serious for the future prospects of humanity, have been environmental.

The natural world, and all the systems which comprise its structure, are now subject to impact or transformation by the technical systems of human society. Were these two sets of systems (natural and technical) perfectly articulated and balanced, both could function and develop, each constrained but not degraded or destroyed by the other. This ideal state is probably unattainable, but its opposite would be the destruction of natural and ultimately of technical systems and hence of civilized man himself.

The primary operational task of public environmental policy is therefore to obtain the harmonious integration of technical and natural systems. This task provides the conceptual framework for this study guide. It tries to make the field of study manageable by placing the specific problems and issues of environmental policy in their appropriate systemic context. Emphasis is on broad systemic relationships because it is within this context that, in the judgment of the authors, the environmental problems of modern society can be most accurately defined and effectively resolved.

This conceptual approach accounts for our treatment of environmental pollution and of resource depletion as symptomatic or secondary problems of policy. The primary policy problem is to correct the over-stressing and mismanagement of natural systems which has resulted in a wasteful depletion of resources and environmental amenities and a degrading and even dangerous "pollution" of the environment. Attacks upon symptoms out of context may result in costly and ineffectual undertakings and sometimes lead to crises worse than the original problems. Efforts to reduce air pollution through automobile emission controls, or to control floods through reliance upon reservoirs and levees, illustrate the difficulties and inadequacies of policies directed toward symptoms rather than toward fundamental causes which ultimately must be confronted.

Although the numbers and distribution of human populations is a major factor in man-environment relationships, we have not dealt with the population issue per se. The effects of population pressure on resources, life styles, and environment are considered at many points in the topical outlines. But the issue of public policy for population is equal in importance to that of environment and involves a large number of considerations that (at least in a direct relationship) may be treated as extraneous to the environmental issue. Our omission of population from the topics covered in this study guide is in no way a depreciation of this crucial issue; it is rather a recognition of the separate although related character of population policy and of the practical difficulty of giving it adequate treatment within the limitations of this publication.

Defining the Subject Matter: Classification and Content

It is not, therefore, the substance of things as such that is the subject matter of environmental policy; it is instead relationships among things, and the consequences and implications of these relationships for human society. Environmental policy studies need not include all aspects of environmental phenomena and, obviously, not all aspects of the objects or phenomena involved in environmental relationships. Some knowledge of the substances or phenomena is necessary to an understanding of environmental relationships. For comprehension of the broad field of environmental policy, a vast amount of substantive knowledge is required; but the way in which this knowledge is organized, is critical for policy analysis and decision-making.

The classification of environmental knowledge is further complicated by the fact that any set of environmental problems (e.g., those relating to pesticides, land-use, or wildlife) involve many different types of policy problems. No aspect of environmental policy can be treated exclusively under any single topic; environmental "pollution" is related in various ways to every topic in the Study Guide. Topic 12, on international aspects, potentially overlaps the substantive content of all other topics, but examines them from a special institutional point of view. This does not imply faulty definition of the topics; the interrelating character of the material is inherent in environmental relationships in the actual world.

To fully cover the organization of any main topic, it has sometimes been necessary to include material relating closely to subtopics, which are treated elsewhere in the Study Guide. For example, certain aspects of economic theory in relation to the environment need to be included in the introductory section, Basic Concepts: Cultural and Scientific, and also are essential to Topic 10: Economic Aspects of Environmental Policy. To minimize repetition in this and similar instances, closely related subtopics are cross-referenced through use of the abbreviation cf. (compare). Thus, material relating to a subtopic followed by this reference may be found under other main topics as indicated. References cited at different places in the Study Guide may also be intended for use in different ways or in different contexts.

The organization of the subject matter by topical outlines with keyed references maximizes the flexibility of the Study Guide for the teacher or learner. Our material may easily be rearranged according to some other organizational plan. Selective use may be made of the material, with various topics or subtopics omitted. We have tried to combine comprehensiveness and flexibility without unnecessary repetition. Under Topics 04, Environmental Health and Human Habitation, and 08, Ecosystem Management and Land-Use Control, we have subdivided the bibliographies into four groupings, A through D, corresponding to the clustering of the literature. We have found no system of classification that is in every respect satisfactory. But the categories that we have adopted seem to us to provide a valid and intelligible structuring of the field of knowledge while at the same time giving viability to some of the major areas of environmental concern.

Although bibliographical citations comprise the greater part of this volume, the Study Guide is not intended as a substitute for bibliographies or indices to the literature. Our effort has been to assist in the difficult task of organizing the field of study. The "fit" or "match" between the literature and the subject matter of the field of study, as we have conceptualized it, varies considerably from topic to topic. Moreover, there will certainly be areas of relevant literature in English, that we have overlooked. And, publications in other languages, except where translated and generally accessible, have not been included. Consequently, this volume is offered for whatever usefulness it may possess, without pretentions to definitiveness or perfection.

Organization of the field of environmental studies thus presents a tough intellectual challenge to all who confront the task, and this guide should be understood as a contribution to the organization of the field of knowledge. It is not presented as the organization of the field, and its authors question whether any particular conceptual scheme could adequately take account of all aspects of the subject. It is their expectation that this publication will be treated as a tool to be corrected, revised, and refined with experience and the growth of knowledge and understanding. If it makes a positive contribution to the advancement of teaching and research in the field of inquiry, the efforts leading to its publication will have been worthwhile.

SOME NOTES ON SOURCES AND BIBLIOGRAPHY

The enormous increase in the literature of the field during the past few years has made the collection of material for the topical bibliographies a major undertaking, and the selection of items for inclusion difficult. Since problems of environmental policy, law, and administration touch upon almost every aspect of society, the task of deciding on the publications to be included could not be easy.

In general, we have included only those articles, books, and reports which have direct bearing upon problems of environmental policy, law, and administration.

Among the categories of materials which have not been included are:

(1) Material predominantly of a technical nature;
(2) Material which dealt primarily with general problems of science policy and devoted relatively little attention to environmental problems [Much of this literature has been included in our previous publication, Science, Technology and Public Policy: A Guide to Advanced Study, revised in 1972, as well as in several other collections referred to in the topical bibliographies.];
(3) Editorials or unsigned articles;
(4) With certain exceptions material published before 1960;
(5) Material printed in languages other than English; and
(6) Texts of speeches, doctoral dissertations, and material difficult to find in even most of the larger libraries.

In addition, when an author has written several books or articles on roughly the same subject, we have frequently included only the most recent or comprehensive, on the assumption that references to his other work will be found there.

Some exceptions have been made to the general criteria mentioned above, when it was felt that more would be gained by the inclusion of a particular item than by consistency in the criteria for selection.

Many of the entries could have been included under several topics. Considerations of space forced us (with some exceptions) to list each item only once--hopefully under the topic for which it was most suitable.

Government documents, as well as reports, pamphlets, and monographs, published by educational and industrial organizations, have been included in the category of "books" under each topic.

Among a number of bibliographies relating to environmental affairs, the exchange bibliographies published by the Council of Planning Librarians [P. O. Box 229, Monticello, Illinois] contain many compilations useful for environmental studies. The Center for Environmental Communications and Education Studies at the University of Wisconsin at Madison has published several bibliographies of environmental periodicals, the most recent appearing in January 1974.

A number of continuing services are now available that may greatly assist the searcher for environmental information. Following are some of the more generally available publications. Searchers should, however, consult reference librarians regarding new services and changes in the format of those presently published.

One of the more comprehensive is the Environmental Periodicals Bibliography published bimonthly with annual volumes beginning in 1972. This service comprises as many as 260 environment- and ecology-related journals and is indexed to provide subject matter, biographic, and geographic keys to each entry. A cumulative index is issued with each volume.

Possibly the single most comprehensive bibliographical source is The Environment Index published since 1971 by the Environment Information Center in New York City. Citations include articles from 3,500 periodicals, government documents, conference proceedings, research reports, newspaper articles, books, and films. Copies of documents cited in the Index can be obtained from the Center in hardcover or microfiche. Among other services by this publisher is Environmental Information Access which, on a biweekly basis, provides approximately 500 to 600 abstracts of environmental publications grouped into 21 categories.

Several environment-related bibliographical services are provided by the United States Government. Among these are two publications of the Department of Commerce: Government Reports Announcements (semimonthly), and Weekly Government Abstracts: Environmental Pollution and Control, both issued by the National Technical Information Service. A large number of bibliographies are published by the Environmental Protection Agency, but the format of these publications has varied considerably. Students of environmental policy and administration should be acquainted with the Socioeconomic Environmental Studies Series issued by the Office of Research and Monitoring (e.g., Bibliography of R & M Research Reports, January 1973) and with abstracts from foreign environmental literature. Most students will benefit from the assistance of a government documents librarian or from direct inquiry to the Office of Research and Monitoring of E.P.A. in utilizing this information source.

In the field of environmental law, at least three sources should be noted. The Environment Reporter, published monthly since 1970 in loose-leaf format by The Bureau of National Affairs, covers a wide range of United States Federal statutes, orders programs, policies, and directories. The Bureau also provides, as an optional service to subscribers, computer searches in special areas not on the list of monthly topics covered in the *Environment Reporter*. Individualized search of the files of the Smithsonian Science Information Exchange (records of research on progress in all fields of basic and applied science) and abstracts of completed literature from the computerized files of the National Technical Information Service may also be obtained. A second source is the annual *Environment Law Review* published by Clark Boardman, edited by H. Floyd Sherrod, and reprinting, since 1970, articles selected chiefly from principal law journals. A third source is *Environmental Law* (now in two volumes), prepared by Arnold W. Reitze, Jr. and published by North American International. The first volume, on pollution control (1972), is now in a second edition; and the second volume, *Environmental Planning: Law of Land and Resources*, appeared early in 1974. This impressive synthesis incorporates legislative histories, court rulings, administrative decisions with extensive analytic, bibliographical, and interpretive commentary.

In addition to these services and compilations, there are a number of journals devoted largely or exclusively to environmental law or policy. Among them are the *Natural Resources Journal* (School of Law of the University of New Mexico); *Environmental Law* (Northwestern School of Law of Lewis and Clark College); and *Environmental Affairs* (Environmental Center of Boston College Law School).

Examination of these bibliographic sources and services will readily reveal why it is impossible to be thoroughly comprehensive in any guide to the literature of environmental policy, law, and administration and why it is difficult to be selective. One can have little assurance that the "best" of any aspect of the literature can be selected for the general reader. It is unrealistic to expect that, in most instances, one can do more than to select from among the better published material. And moreover, this study guide is primarily an effort to contribute to the organizing of the field of environmental policy studies. It is only, incidentally, a bibliography and, in no way, an alternative to the above cited continuing publications.

Finally, note should be taken of the comprehensive general bibliography on environment prepared for the Environmental Protection Agency by Denton E. Morrison, Kenneth E. Hornback, and W. Keith Warner. This voluminous work cites nearly 5,000 books and articles and contains a valuable subject-title index. Full citation to this work is as follows:

> *Environment: A Bibliography of Social Science and Related Literature*. Compiled by Denton E. Morrison, Kenneth E. Hornback, and W. Keith Warner. Washington, D.C.: Office of Research and Development, United States Environmental Protection Agency, February 1974, 860. [EPA-600/5-74-011], Socioeconomic Environmental Studies Series of the E.P.A.

I

BASIC ENVIRONMENTAL CONCEPTS
INTRODUCTION AND BACKGROUND

There are two reasons for prefacing this study guide with a section on concepts relating to environmental relationships.

First, policy issues and decisions are not always comprehensible solely upon the basis of the immediate facts and circumstances. Behind the apparent facts are the less apparent attitudes, values, and ideas. These conceptual factors may be broadly categorized as psychological, and they are a part of man's evolutionary-historical legacy. They may influence action without the actor being aware of the nature of the influence. This legacy, whether or not it is recognized, nevertheless constitutes the cultural or intellectual context of policy and must be understood to the extent that the basis of policy is to be understood.

Second, if changes are needed in policies, laws, or institutions, it becomes necessary to take account of this conceptual context in developing strategies for change. The massive evidence documented in this study guide points strongly to the conclusion that major behavioral changes are imperative if modern society is to avoid ecological disaster.

Although this "background" material is extraneous to most environmental policy decisions, it is, nevertheless, relevant to them. An understanding of the concepts underlying human behavior in relation to the environment could assist a more rational and effective outcome for environmental strategies and decisions. Therefore, material relating to this conceptual context has been provided as a convenience to students and all other users.

Although it has been hardly more than a decade since some governments began to commit themselves, at least in principle, to an ecological approach to environmental policies, it has become apparent that this commitment cannot easily be honored in practice. Many persons have believed that most environmental problems are amenable to technological solutions. Where the appropriate technology does not appear to be available, for example to control SO_2 stack emissions, there is generally an expectation that research and development will be able to provide it. But one must be blind to the actual state of the environment, and to the actions of modern societies, to fail to see that technology is not being utilized to the extent of its capability to protect and improve the environment. Moreover, it becomes increasingly clear that the most fundamental questions regarding the environmental policies of modern society have no technical answers. In the broad sense, these questions are philosophical. They involve attitudes, choices, and values and are difficult to define with precision or to quantify in a meaningful manner.

Failure to understand the secondary character of most technological solutions to environmental problems has led to widespread frustration and disillusion among contending political forces. When policies are directed toward symptoms rather than toward causes, the results are likely to be disappointing. But the remedies that could remove the real causes of environmental disruption are often beyond the prevailing limits of technical and social feasibility. Many environmental controversies, as presently structured, are irreconcilable because the basic assumptions of the participants are logically incompatible. In extreme cases, the political issues are not even joined because their contending proponents are not really talking the same language--to the extent that languages are expressive of attitudes, beliefs, and values.

Comprehension of differing viewpoints would not necessarily lead to agreement; but, if the bases of differences were understood, these differences might be dealt with in a more rational manner than can be reasonably expected amidst conceptual confusion. More serious, to some observers, is the challenge of the sciences (and especially of ecology) to political doctrine and practice. Can popular sovereignty be "right" if, and when, its premises and conclusions are demonstrably "wrong"? Is faith in human adaptability and ingenuity sufficient protection against a highly probable environmental disaster? In the concepts and behavior patterns of man are the roots of the present and worsening predicament of mankind. The study of policy begins, therefore, not only with man's objective condition, but equally with what he believes as expressed in his behavior.

A major theme in the literature of environmental policy is the transition from open-system to closed-system assumptions about the Earth. The phrase "predicament of mankind" summarizes a complex body of ecological thought embracing population quantity and quality, condition of the biosphere, availability of natural resources, and the interactions between technical and natural systems. Humanity has built itself into a labyrinth of incompatibilities, shortages, hazards, and limitations from which no early or easy escape seems possible. To overcome this predicament nothing less than the formulation of a new approach to goals and patterns of human existence will be necessary.

The way people see and understand their environments influences their actions in relation to their environmental circumstances. Intentionally or inadvertently, concepts of man-environment relationships are expressed in environmental policies. But of course it is the behavior, and not the concepts, that directly impinges upon the environment. Concepts are nevertheless basic to policy. People cannot purposefully reconcile their technical systems with natural systems unless they understand the need to do so. Their interpretation and evaluation of environmental relationships can affect their intentions and their actions. To the extent that their acts are guided by valid understanding of nature and technology (e.g., are "scientific") people are more likely to foresee the consequences of their actions and to achieve intended results.

Scientific concepts and science-based attitudes are, of course, aspects of human culture. And the boundary between science and prescientific or traditional beliefs and values is not always clear. Folklore, myth, and theology have sometimes interpreted nature in ways that science has subsequently verified. And science is a human creation that has always been influenced by human purposes, values, and biases. The ideational base of environmental policy, law, and administration is thus a mixture of science and nonscientific elements. Recognition of these elements, and the way they have been combined in environmental attitudes and behaviors, is necessary to a full understanding of public action in relation to the environment. For these reasons, the twelve main topics of the Guide are preceded by this section consisting of background material relating to the historical development of attitudes toward nature and the human environment.

Readings listed in this introductory section are largely expository and analytic. They describe and explain man's environmental attitudes, but are not intended to exemplify them, although some do. The reader should know that the bibliographical items are not intended to include illustrative statements of environmental attitudes and values. Such statements would require a different, longer and, perhaps, more interesting list of published works. This distinction should explain why certain eloquent statements of man's relationship to nature are not included; as for example, Liberty Hyde Bailey's The Holy Earth or Aldo Leopold's Sand County Almanac. There is no discernible end to the number of books, poems, and dramas expressing environmental attitudes and beliefs. Henrik Ibsen's play, An Enemy of the People, illustrates almost every attitude toward man's environment that appears in contemporary conflicts over pollution control. And, if all writings that have significantly influenced environmental attitudes were listed, the oldest entries would precede The Bible.

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LEADING QUESTIONS

1. Environment has different connotations in different disciplines. What are some of these special usages? For example, in astronautics, ecology, organization theory, physiology, public health, and urban sociology? What is meant by "human ecology?"

2. Are the concepts of ecology and environment more difficult to define than social justice, civil rights, full employment, or national sovereignty?

3. What is the meaning of "environmentalism," and why did it fall into disrepute in social and geographical research? Who are contemporary "environmentalists," and is this epithet meaningful?

4. If man is adaptable, why should it be necessary to curb pollution? Wouldn't it be easier and more economical to train future generations to adapt to pollution rather than try to control it?

5. What psychological or social theories have been most clearly identified with environmental concepts and in what respects (e.g., Gestalt psychology, Lewin's field theory, natural selection, Marxism)?

6. Explain the "Spaceship Earth" concept and compare it to prior concepts of man-environment relationships. Is an ecological orientation consistent with the values and institutions of industrial society?

7. Primitive men are alleged to be more respectful of their environments than modern men. What evidence supports this allegation or explains the differences in attitude?

8. Why has it been difficult for many otherwise well-informed and intelligent persons to understand environmental or ecological relationships?

9. What evidence suggests that man's attempts to dominate his environment are the result of (a) inner bio-psychological drives, or (b) cultural conditioning (e.g., by social myths)?

10. What factors explain the method and timing of the emergence of ecology as an academic discipline. Why has ecology been called a "subversive science?"

II

ENVIRONMENT AS A POLICY ISSUE
ORIGINS - CHARACTERISTICS - IMPLICATIONS

During the decade of the nineteen sixties, the "quality of the human environment" grew from the concern of a few scientists, naturalists, and planners to a movement of worldwide proportions. If any single event catalyzed this movement, it was the publication in 1962 of Rachel Carson's Silent Spring. The global concern was signalized in Resolution 2398 (23) of the United Nations General Assembly on December 3, 1968, calling for a world conference on the human environment.

Origins of this concern predate all of these events, going back to at least 1864 when George Perkins Marsh, United States Ambassador to Italy, published Man and Nature; or Physical Geography as Modified by Human Action. Concern for the quality of the environment was latent in the American conservation movement, which began as an effort toward more prudent and efficient use of natural resources and evolved into a movement to protect soils, forests, and wildlife throughout the biosphere. It provided a means for thinking about the human environment in global terms. The Apollo Space Flight photographs of the Earth from the Moon dramatized the ecological unity of the Planet and reinforced the idea of the biosphere as the planetary life-support system.

Public awareness of environmental deterioration is a necessary but insufficient basis for remedial public action. The causes of environmental deterioration are inherent in the attitudes, behavior patterns, and institutional arrangements of society. In order to improve its environmental conditions a society must reform itself. Adding to the difficulty of this task is the usual circumstance that environmental quality is not perceived or evaluated in the same way by all members of society. And the development of sound and persuasive public policy is further handicapped by a lack of knowledge concerning the ultimate effects of present trends.

TOPIC 01 EMERGENCE OF "ENVIRONMENT" AS A PUBLIC ISSUE

A critical level of public concern was necessary before the human environment could emerge as a public issue. We have no precise index to tell us when this critical point was reached. Evidence of its approach may be obtained, however, from content analysis of the news media, of political rhetoric and legislative proposals, and of the subject matter of civic and professional meetings. In the United States and Western Europe, emergence of an environmental quality movement could increasingly be seen during the nineteen seventies. Environmental deterioration was becoming so apparent that only the least sensitive individuals could fail to observe it. But of equal importance was a rising standard of public expectation concerning the quality of the environment. This heightened public concern arose in part out of the growing knowledge of man-environment interaction, in part out of growing affluence, mobility and leisure, and in part out of confidence in the ability of science and technology to solve human problems.

The environmental quality movement was a convergence of several separate efforts in resources conservation, public health, architecture, town and country planning, and in the young science of ecology. From these and other sources emerged a composite philosophy of public responsibility for man-environment relationships. The basis of this philosophy has been the finite character of the Earth, the vulnerability of its ecosystems, and the ultimate necessity for balance and self-renewal among its components. It represents a closed-system view of the Earth, in contrast to widespread, historical, open-system assumptions. Closely related is the effort for population planning and birth control. Numbers of people, plus their demands upon the environment implemented by technology, are obvious factors in the attrition of environmental quality. Public policies for the most part, however, have not clearly joined population to environmental policy. Environmental policies are more widely accepted and easier to cope with than population. And the environmental issue has frequently been narrowly interpreted as primarily environmental pollution.

The emergence of "environment" as a public issue in the United States is clearly visible in the legislative records of the 90th and 91st Congress. During the years 1968 and 1969, environmental quality took shape as a comprehensive and coherent public issue, culminating in the National Environmental Policy Act of 1969. The broader significance of "environment" as a quality of life issue, differing from the traditional subject matter of American politics, began to unfold during the decade of the nineteen seventies.

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TOPIC 01 EMERGENCE OF ENVIRONMENT AS A PUBLIC ISSUE

TOPICAL OUTLINE	REFERENCE KEY
I. Cultural Roots of Nature Protection and Environmental Quality (cf. Basic Concepts: Cultural and Scientific)	
A. Reactions against formalism, industrialism, and urbanization	241
1. Romantic movement in philosophy, literature, painting	
2. Agrarian idealism	
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1. Human impact on the physical world (e.g., George Perkins Marsh, *Man and Nature*, 1864)	
2. Efforts to protect natural beauty and extraordinary natural phenomena (e.g., Yellowstone National Park, 1872)	
C. Growing awareness of environmental conditioning on human behavior	
1. Beginnings of public health movement	
2. Beginnings of urban sociology (e.g., human ecology as environmental sociology)	
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b. Protection of sites and landmarks	
c. Protection of wildlife for	
(1) Hunting in game parks	
(2) Economic benefits to agriculture	
(3) Species preservation	

2. Beginnings of voluntary organizations — 284, 307
    - a. In the United Kingdom — 237
        - (1) Commons, Open Space, and Footpaths Preservation Society (1865)
        - (2) National Trust for Places of Historic Interest or Natural Beauty (1895)
        - (3) Society for the Protection of Birds (1889)
        - (4) Fauna Preservation Society (1903)
        - (5) Society for the Preservation of Nature Reserves (1912)
        - (6) British Ecological Society (1913)
        - (7) Council for Nature (1958)
    - b. In the United States — 151, 326
        - (1) American Forestry Association (1875)
        - (2) Appalachian Mountain Club (1876)
        - (3) Sierra Club (1892)
        - (4) National Audubon Society (1905)
        - (5) Ecological Society of America (1915)
        - (6) Izaak Walton League (1922)
        - (7) Natural Resources Council (1946)
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4. Divergence among American conservationists — 151, Addenda B
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        - (1) Gifford Pinchot and the Forest Service
        - (2) The "Reclamation and Inland Waterways" Movement

        (3) George Norris and the Tennessee Valley Authority
    b. Conservation as nature protection and as preservation
        (1) Adirondak Forest Preserve (1892)
        (2) John Muir and the Hetch Hetchy Valley
        (3) The National Park Movement
        (4) The Historic Preservation Movement
        (5) Legislation to protect wildlife
5. Governmental response to the conservation movement — Addenda B
    a. Conservation as a "progressive" doctrine
    b. Post World War I reaction
    c. Conservation under the New Deal
    d. Post World War II official indifference
    e. J.F. Kennedy and the End of the Historic Conservation Movement

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    a. Early modern commentators on relation of urban conditions to health
    b. Edwin Chadwick, John Simon (1842-1866) and the public health movement in the United Kingdom
    c. Lemuel Shattuck and Report of the Massachusetts Sanitary Commission of 1850
    d. Beginnings of occupational health
2. Impact of pathology and medicine on public health practice
    a. Work of Louis Pasteur and Robert Koch in microbiology and immunology (1870's and 1880's)
    b. Shift in emphasis from sanitation to quarantine and immunity

c. Neglect of psychological and aesthetic aspects of environmental welfare
3. Rediscovery of the environment (1960)
a. American Medical Association Environmental Health Congresses (1964-1969)
b. National Sanitation Foundation (1944)

C. Urban and regional planning movement (cf. Topic 04) — Addenda C
1. Beginnings of modern city planning
a. The baroque city: Versailles to Petersburg to Paris rebuilt
b. Early-planned cities in America
2. Short-lived efforts to plan and beautify American cities
a. Impact of the Columbian Exposition of 1893
b. Urban growth outruns planning
3. Town and country planning in the United Kingdom and the United States
a. British Town and Country Planning Act of 1947
b. Environmental planning generally frustrated in the United States

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a. Relationship to theories of evolution and succession
b. Ernst Haeckel (1869)
c. British Ecological Society (1913)
d. Ecological Society of America (1915)
2. Ecosystems concept and the biosphere
a. A.G. Tansley ("ecosystem," 1935)
b. V.I. Vernadsky, The Biosphere (1926)
c. Linkage of ecosystems theory to general systems theory

3. Reorientation of conservation organizations toward broader public policy emphasis	
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2. Oil spills: The Torrey Canyon (1968); Santa Barbara (1969)	
3. Fish kills: Rhine (1969); Mississippi (1964)	
4. Poisoned ecosystems: Cranberry scare (1959); Minamata disease (1950--)	
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2. Testing of enforcement procedures in air and water pollution control cases

B. Beginnings of integration of environmental policy with policies for population, land-use, materials, and energy
1. Conceptual integration in efforts to describe or prescribe for the "predicament of mankind"
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   b. Integrated approaches in the policy recommendations of the
      (1) National Commission on Population and America's Future (1970)
      (2) National Commission on Materials Policy (1970)

C. Universalization of environment as a public issue (cf. Topic 12)

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LEADING QUESTIONS

1. What are the major differences between the attitudes and values of traditional conservationists and modern-day environmentalists? How can we account for these differences?

2. Theodore Roosevelt managed to save many natural areas through his bold use of Presidential powers. How do methods practiced by Roosevelt differ from methods used to implement environmental policy today?

3. How do attitudes toward the environmental movement in underdeveloped countries differ from those in the techno-economically advanced countries? To what can this be attributed? Are these differences changeable?

4. What is the relationship between President Lyndon B. Johnson's "Natural Beauty" program and present-day environmental programs? Did the Johnson program fail?

5. What have been the successes and failures of the National Environmental Policy Act of 1969 (PL 91-190)? Is there any indication the law may be too successful? What are some of the proposals to modify the Act and the reasons behind these proposals?

6. What have been the arguments of the political "right" and the "left" against the environmental quality movement? Are these rational objections?

7. The June 1972 United Nations Conference on the Human Environment was probably the most important meeting in modern times on the environmental problem. What issues and arguments dominated that Conference? What was the result?

8. Growth has been identified as a major factor in the environmental problem. What are some of the opinions expressed on "growth" by various groups such as agriculture, business, labor, science, and religion?

9. Is the environmental quality movement no more than a temporary upper-middle class American enthusiasm? Will people support the costs of environmental quality?

10. What evidence have we concerning attitudes of people in the United States and in other countries toward environmental issues? Is there evidence sufficient to rank countries by priority accorded "environmental" quality?

TOPIC 02 SYSTEMS APPROACH TO ENVIRONMENTAL POLICIES

In principle, the cause of the environmental problems of our times is a mismatching of technical and natural systems. The greatest impact of human society upon its environment occurs through the improvident exactions of man's technical systems in agriculture, fisheries, forestry, mining, transportation, and urbanization from the natural systems of land, sea, air and living organisms that comprise the biosphere. The intensity, extent, continuity, and destructiveness of these exactions from nature have resulted in resource depletion and environmental pollution. Environmental degradation and the impoverishment of the natural life-support system may therefore be seen as consequences of failure to bring the management of man's technical systems into harmonious and sustainable relationships with the ecosystems of the natural world. Rapid and excessive population growth increases the pressures on natural systems, worsening the effects of misapplied technologies.

A concomitant to the realization that the impact of human society upon the environment occurs primarily through misapplied technology is recognition that, as technological society grows in size and complexity, its effects become increasingly those of interactions among comprehensive systems. Thus individuals and local communities in modern industrial states are severely limited in what they can do unaided to protect environmental quality. Even the greatest nations cannot unilaterally protect themselves from impacts of technology that transcend political boundaries and may even affect the planetary biosphere. This implies an approach to environmental problems as systems phenomena, and the development of policies and implementing institutions capable of dealing with environmental problems in systems contexts and not merely as isolated events.

The systems approach to environmental policies is based upon propositions exemplified by the body of concept and analysis called "general systems theory." Environmental policies have also been influenced, often directly, by ecosystem analysis, by cybernetics or the theory of control through feedback, and by ecological psychology. Until very recently, the effect of systems theory upon environmental policy was evident largely at the conceptual or theoretical level. Its influence was largely felt among scientists and engineers. Popular ways of thinking and prevailing institutional arrangements were poorly adapted to systems applications. But practical applications of the systems approach are increasing, partly due to more adequate general understanding of linkages and other interrelationships among environmental events, and partly because of the untoward consequences of narrow, linear attacks upon environmental problems (as in "pest" control through cheap, persistent pesticides) that have often created new environmental problems without adequately resolving old ones.

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TOPIC 02 SYSTEMS APPROACH TO ENVIRONMENTAL POLICIES

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A. Definitions and properties of systems	88, 96
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2. Distinction between concepts of the "systemic" and "systematic"	
3. Particular applications of systems concept: social, industrial, scientific	17, 97, 141, 145, 187, 188
4. Criticisms of the systems concept and its utility	13, 22, 89, 106, 170
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1. Systemic explanations of ordered relationships in the natural world	
2. Systems theory as a response to difficulties caused by complexity and overspecialization	
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a. Empirical	
b. Mechanical construction	
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4. Concepts of levels of organizations: complexity as a critical variable	
5. Institute for Applied Systems Analysis (Vienna, 1972)	

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(2) Environmental relationships at the man-machine interface	
(3) Environmental influences (cultural and natural) on the structuring and behavior of human organizations	115
c. Self-organizing structure and behavior: the search for explanation	92, 140, 158, 204
II. Advantages of the Systems Approach to Environmental Analysis and Decision-Making	7, 18,25,28,32, 34, 40, 144, 175, 193, 206,208,214, 220, 221
A. Aid to conceptualizing of complexity	55, 81
1. Provides models of perceived reality in an intellectually comprehensible form	
2. Makes structural relationships explicit	
3. Makes dynamic multiple relationships conceptually manageable	

B. Forces a search for all significant parameters of a problem — 43, 44
   1. Identification of boundaries in time, space, and circumstance
   2. Helps to isolate critical factors within their context
   3. Enables construction of hierarchy of significant factors and description of interdependencies and sequential processes

C. Helps to clarify meaning of optimality
   1. Requires any event or project to be approached in relation to its context — 46
   2. Assists development of hierarchy of goals; helps to avoid suboptimization
   3. Assists identification of alternative courses of action and probable consequences

D. Assists calculation of costs and benefits — 107, 120
   1. Provides a systematic way of calculating the total flow of energy and materials in the environment
   2. Examination of total system helps to identify unrecognized benefits and costs, and costs that are being "externalized"
   3. Aids in the identification of nonquantified or nonquantifiable factors

III. Limitations of the Systems Approach — 13, 22, 170

A. Mere fact of "system" not necessarily significant for environmental policy

B. Specific events not always predictable from behavior of the system (e.g., variable factors in a system)

C. Predictability of systems behavior may vary with changing conditions

D. Systemic effects may not be amenable to any human influence or control

IV.	Application of the Systems Approach to Environmental Analysis and Decision-Making	12, 31, 43, 44, 48, 53, 56,73, 74,120, 173,179, 182, 184, 186,189, 196, 197, 201, 202,210, 211, 216, 222
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LEADING QUESTIONS

1. Distinguish the special meaning of "system" in each of the following usages: general systems, systems analysis, systems management, ecosystems, open and closed systems, self-organizing systems, systematic and systemic effects.

2. State the similarities and differences between a "systems" and a "cybernetic" approach to environmental phenomena.

3. What are the demonstrated strengths of the systems approach to environmental affairs? What are its limitations and liabilities?

4. What linkage is there between the concepts of systems and of optimality? How does the systems approach protect against suboptimization?

5. How are modeling and simulation associated with the systems approach? What are the "mechanics" of their association?

6. How has games theory and practice become related to modeling, simulation, and the systems approach? What are some of the better developed environmental games? How are they constructed and tested?

7. What criticisms have been leveled at environmental modeling and simulation? Cite criticisms of specific models: for example, Limits to Growth and World Dynamics.

8. Cite some specific applications of the systems approach to environmental problems (e.g., ecological methods of "pest" control).

9. How might the systems approach be built into public deliberation and decision-making on environment-related issues? What efforts have been made to achieve appropriate levels of participation.

10. What evidence is there of governmental interest in the systems approach to environmental policy? In the United States? In other countries? In international organizations?

TOPIC 03 ENVIRONMENTAL ASPECTS OF RESOURCES POLICIES

Men compete with men and other organisms for space and for the life-supporting substances of the Earth. These substances are commonly termed "natural resources." Whether they are actually perceived to be resources at any particular place or time depends upon the state of knowledge and technology. Uranium, for example, was not a resource to the Romans. It is therefore difficult to define exactly what is meant by the term "natural resources." This topic will primarily focus on "materials"--the physical substances from which the artifacts and structures of human society are made. These are primarily minerals, metals, clays and aggregates, wood and vegetable fibers, and fossil fuels. Living resources in wildlife, fisheries, and agricultural products are also considered under Topics 04, 08, and 12 and will be treated under this Topic only in connection with broader resources policy issues. Similarly, air, water, and soil are given special attention in Topics 06, 07, and 08 and are considered under Topic 12 in their international context.

The resources concept is essentially economic. Unlike the ecological approach to the natural world, the economic resource concept tends to be reductionist and disintegrative. Ecology offers a systemic view of nature and is interrelating and integrative in character. But resources, like merchandise in a supermarket, are abstracted from the environment and are grouped into classes of goods, identified by their practical utility to human society.

In economic practice, however, these resources, particularly those more exactly identified as "materials" may be treated in an integrative manner. Substances taken from nature are combined and structured into forms useful to man. The mechanism of this transformation is technology. But unless the materials remain indefinitely usable as artifacts (e.g., clothing, buildings, machines, etc.) they will either be returned to the natural environment or will remain as useless or even harmful residuals (wastes), depleting available reserves of materials and polluting the environment. An environmentally sound policy for the use of materials therefore requires total materials management with maximum feasible recycling.

The principal objects of resources policy have been: (1) discovery and acquisition, (2) development and exploitation, (3) conservation and recovery, and (4) replacement or substitution. During the earlier years of modern industrialism, competition for control over reserves was the major public issue relating to resources. By the 20th Century, however, the prospect of resource depletion gave rise to the conservation movement for a more responsible use of resources. By mid-century the focus of conservation efforts began to shift rapidly toward the impact of resource management upon the natural environment. In the latter third of the century, the necessity for public planning and regulation of resources utilization has become widely accepted.

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LEADING QUESTIONS

1. What is the meaning of the term "natural resources"? How does it relate to "environment"? How is it distinguishable from materials? What utility is there in distinguishing between raw or virgin materials and used or recycled materials? What semantic traps are hidden in these terms?

2. What has been the environmental impact of technology upon resources exploitation? How could technology be used to lessen the environmental damage associated with resources management? Why has this seldom been done in the past?

3. What are the implications of dwindling nonrenewable resources? How can these resources be extended and what responsibility does this place upon policy-makers? Can reliance be placed on substitute materials?

4. What are the major problems of materials recycling? What did the National Commission on Materials Policy recommend to alleviate them?

5. It has been said that, in the long run, "The Green Revolution" will cause more deaths than it saves lives. What is the basis of this contention and what evidence supports it? Should "The Green Revolution" be abandoned?

6. New strains of rice and wheat developed for tropical countries produce much greater yields but also require large amounts of artificial fertilizers and pesticides. What implications does this have for energy, the environment, the economy, and international relations?

7. Exploitation of the oceans has been proposed as one way to stave off world starvation and materials shortages. What does the evidence indicate in relation to the validity of this proposition?

8. Plans are under way to open the Amazon Basin to settlers and agriculture. What are some of the arguments for and against these proposed actions?

9. What changes have occurred in resources policies in the United States during the past quarter century? What indications do you see of future trends?

10. The Limits to Growth postulates an eventual collapse of the present industrial system throughout the world if present energy and resource-use policies are followed. What is the reasoning behind this thesis? What can be said for and against it? Does "Blueprint for Survival" offer a feasible alternative?

TOPIC 04 ENVIRONMENTAL HEALTH AND HUMAN HABITATION

The environmental needs of modern man have resulted from thousands of years of selective evolution, shaping the physical and cultural characteristics of the human species and, especially through advanced technologies, radically modifying the conditions under which man emerged. In the earliest or more primitive human settlements, natural selective processes operated to ensure that minimum ecological necessities were met. But with the advancement of civilization, techniques of food production, water supply, housing and sanitation permitted progressively larger concentrations of population. New demands upon the environment emerged and technical systems for supporting large cities (e.g., energy supply and waste disposal) placed ever greater burdens on the natural environment. The developing urban environment also changed, and was often accompanied by increased stress on human minds, bodies and social institutions.

Human society has adapted its behavior and that of natural systems to the conditions of urban life. These modifications have enabled society partially to evade, postpone or modify natural selective processes, but not to avoid them indefinitely. The effects of these adaptations, which are largely behavioral rather than genetic, are seldom readily apparent. Years and generations may pass before the consequences of change become evident. Yet we know that adaptations, even the most advantageous, exact some price from man and his environment. No systems, technical or natural, are infinitely adaptable, and there are limits beyond which man cannot safely attempt to change himself or nature.

There is therefore a need to discover the true nature of the ecological and psychophysical costs that modern man is incurring as a consequence of the conditions of modern urban life. Even without this knowledge it should be possible to plan and build settlements and develop patterns of behavior that are much better adapted to human welfare than many of those now existing. Human ecology is a rapidly growing field of inquiry, and a number of theories and experimental efforts have been advanced as a basis for planning communities. The resulting knowledge, properly validated, should reveal the extent to which human life is being improved or impaired by existing conditions, and could provide incentive and direction for the reshaping of social institutions upon ecologically valid principles.

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LEADING QUESTIONS

1. What is the significance of environment as a factor in human health and how has this significance been evaluated in the public health movement?

2. How many specific types of environmental influence upon health can be enumerated? Can direct and indirect influences be distinguished? Can environmental influences always be classified as beneficial or harmful?

3. Are cities necessarily less healthful than rural areas? What factors appear to determine the healthfulness of a geographic area?

4. What are the major ecological problems of human settlements? To what extent could technology and planning alleviate these problems?

5. Are there rational arguments for the protection and preservation of nomadic and primitive human life-styles? Is there any chance of any "traditional" societies withstanding acculturation or extinction?

6. Studies of animal ecology have shown that crowding causes various types of abnormal and bizarre behavior. Is there any evidence that the crowding of humans causes abnormal behavior? Are there physiological as well as cultural reactions to crowding; cultural as well as personal tolerances?

7. According to some ethologists, man is a "territorial animal" that lacks a "built-in" or instinctual mechanism to control violence toward his own kind. What are the implications of this theory for environmental policy and planning? For political science and ethics?

8. What have been the demonstrated effects of noise on man? What implications do these effects have on the location of industry and airports?

9. What aspects of ecology are evoked (or ignored) by the following theories or conditions of human habitation: Ekistics (Doxiadis), megastructures and archologies (Soleri), conurbations, ecumenopolis, settlements within geodesic domes (Fuller), or platform cities on the sea?

10. How could an ecologically sound policy for urban settlements be developed and administered? What would be some of its essential features?

III

RECONCILING NATURAL AND TECHNICAL SYSTEMS
OBJECTIVES - APPROACHES - PROCESSES

Human societies have attempted to regulate natural systems principally for two reasons: (1) to avoid or diminish natural hazards and (2) to obtain some desired substance or service from the environment. Efforts to prevent floods, fires, or insect devastations illustrate the first reason; the practices of agriculture, forestry, mining and outdoor recreation illustrate the second. In both categories, however, regulation of natural systems requires regulation of man's behavior in relation to those aspects of the environment that are affected. For example, regulation of natural systems for supply of energy (e.g., coal, oil, uranium, flowing water, etc.) requires that men regulate their own actions not only in obtaining the energy, but in conserving the supply for future needs.

The welfare and survival of man and his civilization depends upon continuing support from natural systems and their components. When these components are identified as answering human needs, they are classified as "natural resources." The resource concept is therefore primarily economic and only secondarily physical. Prudent regulation of man's environmental base to support his material needs must accordingly take account of both economic and physical factors. Biological relationships also must be considered because continuous linkages of energy and nutrition, growth and disintegration join living to nonliving matter.

Governments historically have regulated the exploitation of particular resources, especially forests, salt, precious metals, and various species of wildlife. The most general philosophy of resource management, however, was that expressed through the "Conservation Movement," occurring in the United States primarily during the first half of the twentieth century. Human use of natural systems and resources has been undertaken largely through a special kind of practical knowledge called technology. But neither technical capabilities nor natural systems are infinite. Each is subject to various limitations and counterproductive tendencies, some of which are surmountable, others inexorable. A major aspect of environmental regulation is therefore to maintain and, where possible, to enlarge the capability of natural and technical systems to respond to human needs and demands. Ultimately, however, human exactions from the natural world must be restrained, either by human self-control or through the natural consequences of excessive exploitation.

TOPIC 05 ENVIRONMENTAL IMPLICATIONS OF ENERGY SYSTEMS

Human societies may be classified by the extent to which they make demands upon, and concentrate energy resources of, the natural world. The low-energy demand societies of early men relied mainly upon the natural forces of sunlight, wind, running water, and organic material to reinforce or supplement their own inherent physical strengths. For the most part these energy demands could be satisfied indefinitely without significant effect upon natural systems. Energy resources were self-renewing, and residual or waste products were recycled into the natural environment. The development of fire-using technologies, however, marked the beginning of concentrated high-energy demand societies utilizing fuels. High-energy demand technologies greatly increased total productivity, implemented by machinery fueled by relatively cheap and abundant energy sources (e.g., coal, oil, and natural gas). The productive efficiency of the individual was not increased however; only when the energy of fuels was added to human energy was output (of man plus machine) increased.

Recourse to fuels changed the relationship between technical and natural systems. Unlike the recurring power of wind, water or sunlight, the energy obtained from fuels is dissipated in work and waste. When large quantities of energy are concentrated, as in the generation of electrical power, residual wastes increase in the form of heat, particulate matter, and chemical compounds that may become pollutants of the environment and may prove harmful to plant and animal health and to textiles, metals, and stonework. Moreover, the extraction of high-energy fuels from the Earth, particularly the fossil fuels such as coal and oil, disfigures the landscape. Environmental damage has also been incidental to the transformation or transmission of high-energy fuels, and special difficulties are presented by the radioactive emissions and waste products of nuclear reactors. Thus, although industrial society obtains immense advantages from high-energy technology, a heavy price is paid by man and nature for these advantages.

Not all of this price is necessary however. Some of it is as unavoidable, as the Second Law of Thermodynamics; but much of it is fairly attributed to carelessness or indifference. Careful management of energy-producing materials could significantly reduce the adverse effects of high-energy demand technologies. And it could delay, but not prevent, the ultimate exhaustion of fossil fuels and uranium as energy sources. Thus a vital problem for modern technological society is the discovery of an indefinitely renewable, noncontaminating abundant source of energy. Atomic fusion would come close to meeting the requirements of abundance and long-continued supply, but it would not be wholly free from danger of radioactive contamination. Radically different principles of obtaining energy may be required to overcome the disadvantages of reliance upon fuels. Theoretical possibilities include geothermal energy, solar energy, and tidal energy. But technologies have not yet been developed that could obtain quantities of energy from these sources approximating those now obtained from fuels. And so the management of energy resources promises to be a major concern of environmental (and economic) fueling during the coming decades.

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TOPIC 05 ENVIRONMENTAL IMPLICATIONS OF ENERGY SYSTEMS

TOPICAL OUTLINE	REFERENCE KEY
I. Energy as a Physical Phenomenon	166, 256, 419
A. Interrelation of energy and matter: $E=MC^2$	353
B. Basic principles of thermodynamics	
C. Energy and technology	
1. Potential energy as distinguished from available energy	
2. Meaning of renewable and non-renewable energy sources	234
II. Energy Sources and Technologies: Effects upon the Natural and Social Environment	151, 196, 206, 245, 267, 298, 333, 351, 376, 406, 417, 441, 446, 454, 457, 471, 576
A. Bio-energy--biochemical sources: ultimate source of energy is solar radiation, interacting with minerals in solution (e.g., water) and in an atmosphere (e.g., air)	185
1. Manpower	
a. Collective power of physical human labor (e.g., public works in antiquity)	
b. Influence of energy sources and systems on social structure and behavior	
c. Declining utilization of manual labor in advanced technological societies	
2. Domestic animals	39
a. Early use of draft animals (correlation with agricultural development in some cultures)	
b. Declining use of animal labor as industrialization increases	

3. Cellulose materials
    - a. Wood, grass, and other vegetable products as two sources of energy as
        - (1) Food
        - (2) Fuel
    - b. Conversion through technology to secondary energy source or fuel supply (e.g., charcoal, tars, resins, distillates--turpentine, alcohol)

4. Biochemical processes
    - a. Photosynthesis: natural solar energy system
    - b. Microbial oxidation-reduction processes (e.g., to generate electric current)

B. Geophysical energy sources 48, 49, 107

1. Water power 221
    - a. Direct energy source since antiquity through water wheels, flumes, etc.
    - b. Indirect energy source through turbines to hydroelectric power
        - (1) Utility restricted by geographical factors and capital requirements
        - (2) Special environmental problems of siting and building large dams
        - (3) Environmental problems created by reservoirs
        - (4) Problems of power transmission
    - c. Efforts to obtain energy from oceanic tides and currents; heat exchange by tapping ocean depths 332

2. Wind power 421
    - a. At sea to propel ships, ice boats, etc.
    - b. Stationary windmills for milling and pumping

3. Fossil fuels
    - a. Coal--important industrial heat source since about 1250 A.D.; principal energy source for the 19th Century Industrial Revolution; innovative technologies in uses of coal for energy slow to develop 12, 484; 160, 342, 395, 431, 545

b. Petroleum and natural gas--major domestic and industrial energy source since the end of the 19th Century	262,269, 367, 393, 455
(1) Required development of massive technology and economic organization for exploration, drilling, refining, transportation, and distribution	
(2) Fuel adaptable to the development of a wide range of stationary and mobile internal combustion engines	
(3) Oil shales and tar sands--known reserves greatly increase potential world fossil fuel resources, but exploitation has so far been relatively uneconomic	
(4) Economic, political, and social effects of dependence upon petroleum and natural gas (far-reaching and unstabilizing)	
(5) Polluting and nonrenewable character of petroleum creates problems for nations dependent upon this energy source	
4. Nuclear ("atomic") energy	5,24,40,46,53,73, 89,97,118,176,198, 230,278, 285,365, 425, 438, 442, 464
a. Nuclear fission reactors--power for industrial and mobile sources (ships and submarines) since about 1955	19, 47, 52, 75, 103, 111, 119, 153,169, 172,222, 224,275, 352,387, 465,466, 467, 468, 469, 470, 471, 472, 473,474, 475,476, 477, 478, 479, 480, 488, 498
(1) Required levels of technology and high capital costs have slowed utilization, but there has been a dramatic upturn in use for new stationary electric generating plants	

(2) Nuclear power has involved new relationships between government and industry	32, 83, 145
(3) Public attitudes have been different in kind from those toward other energy sources	121, 129, 164, 191, 217, 218, 225, 251, 253, 280, 301, 321, 329, 379, 399, 451
(4) There are serious health and safety problems resulting from radioactive emissions and hazards in storing or disposing of spent fuel, as well as the potential for theft and subsequent blackmail (cf. Section V, G)	74, 79, 92, 106, 147, 158, 164, 170, 171, 202, 203, 205, 209, 216, 223, 248, 312, 371, 401, 443, 444, 448, 554
(5) Prospect of ultimate depletion of uranium supplies encourages development of Fast Breeder Reactors to extend "life" of radioactive fuels	72, 227
b. Nuclear fusion power?	9, 81, 136, 148, 155, 177, 190, 200, 231, 259
(1) Many technological obstacles remain to be overcome	
(2) Would avoid many of the environmental hazards of nuclear fission, but would probably produce tritium as a pollutant	
5. Solar energy (ultimate source of most other forms of energy)	11, 20, 51, 55, 78, 108, 152, 159, 215, 219, 258, 282, 287, 302, 491, 582, 606
a. Direct use of solar radiation by heat or light concentration (for special purposes and to slight extent)	232
(1) Heat concentration for cooking, domestic heating, metallurgy, heat engines, thermoelectricity	
(2) Light collection for photoelectrical or photochemical generation of energy	

- b. Utility has been restricted by low efficiencies of energy-collection and transformation devices and need for large surface areas relative to energy output
- 6. Other energy sources
  - a. Gravity, through hydroelectric use (pump-storage and tides)--little prospect for significant expansion and highly restricted geographically
  - b. Geothermal energy, so far geographically restricted to some areas with natural hot springs and geysers; potential not fully assessed — 17, 30, 125, 263, 373, 386, 456
    - (1) Heat exchange (e.g., pump heat)
    - (2) General availability dependent on technologies not now available for tapping heat of the interior of the Earth at any point desired
  - c. Wind (ancient method of generating low levels of energy where wind can be relied upon)

III. Man's Energy Requirements — 36, 123, 141, 187, 196, 207, 220, 271, 294, 303, 330, 343, 344, 350, 364, 380, 483, 558

A. Biological requirement: human society can exist indefinitely only where energy dissipated in the process of living is replaced — 112, 204

- 1. Environmental system requirements — 140
  - a. New sources of energy must be found to replace nonrenewable sources which become depleted
  - b. Or: per capita demands on energy resources must drop
  - c. Or: population must drop
  - d. New sources must not only be renewable, but must not present cumulative lethal hazards

2. Energy dissipated in the process of living must be replaced in the form of food. For about the last 100 years, the world's population has increased at a much faster rate than land brought under cultivation, necessitating very energy-intensive agricultural practices	235
B. Material requirements	54, 56, 110, 150, 179, 274, 290, 305, 324, 363, 370, 434
1. Meeting the needs of an ever-increasing number of people for food, clothing, shelter, transportation, education, and health care requires vast consumption of energy	310, 323, 390
2. Material requirements grow exponentially with industrialization and mass affluence	402
C. Cultural requirements (technologies and energy demand)	228, 423
1. Industrial societies have evolved cultural patterns that require large inputs of energy (e.g., single-family homes, suburban living, use of automobiles, motor boats, aircraft, automatic heating and air conditioning, mass advertising, etc.)	
2. Energy transformations may affect the environmental system; and environment-damaging by-products of energy transformations, such as the following, should not be permitted to exceed the rate at which they are 'tolerable' (cf. Section V)	124, 237
a. Chemical pollutants	
b. Radioactive pollutants	
c. Water salinity (as in impounding water for hydroelectric plants)	
d. Thermal pollution	
e. Particulates	
f. Soil erosion	

3. Changes in the amount or form of available energy are likely to result in changes of a society's capabilities, economic and political structure, realizable values, and behavior	293
IV. Primacy of Food as an Energy Source	196, 591, 592, 595, 603, 615
A. Transition from food-gathering to food-raising, and from low-energy demand to high-energy demand agriculture as aspects of the development of civilizations	
B. Levels of energy use in agriculture	593, 594, 608, 614
1. Energy costs of mechanized food-raising are higher than those incurred in hand cultivation	
a. Larger, heavier, and more complex tools replace hand tools--thus require more energy for their production, operation, maintenance, and repair	
b. Greater area covered per production unit requires more energy consumed in travel to and from work site, and in transport of product to consumption area	
c. Large acreages required for mechanized agriculture are not uniformly productive, hence selectivity is lost, and the result is decreased yield for given expenditure of energy	
d. Transition from low-energy demand to high-energy demand agriculture renders fixed assets of the older production obsolete--an energy debit	
e. Finding employment for workers displaced by other energy converters becomes problematic, especially in countries with rapidly increasing populations	

V.	Environmental Effects of Energy Production	4, 8, 86, 99, 104, 156,161, 193,244, 249,265, 283,306, 315,318, 326,331, 374,392, 403,439, 458,485, 497, 527, 552,557, 573,583, 585, 589, 604
A.	Woodcutting for producing energy has resulted in partial or complete loss of forests, widespread erosion, and change of climate (e.g., in Greece, Turkey, and India)	
B.	Mining of coal, especially strip-mining, mars the landscape: water run-off from mines pollutes rivers, lakes, etc.	76, 87, 144, 300, 400,431, 445,447, 482, 507, 518, 565
C.	Offshore drilling for oil has frequently led to fires and damage to the coastline from blow-outs and spills (e.g., in Santa Barbara and the Gulf of Mexico). Oil tankers cause widespread ocean pollution	15, 31, 138, 269, 299, 418, 429, 449, 548, 587
D.	Combustion of fossil fuels in stationary and mobile sources leads to emission of vast quantities of oxides of sulfur, nitrogen, and carbon into the atmosphere: particulates and toxic metals, such as lead and mercury, are also emitted	25, 42, 261, 268, 304,378, 473,549, 550
E.	Waste heat is released into air and water. The temperature rise of some rivers has been sufficient to affect the existence of biological species. Possible impact on the long-term heat balance of the Earth	44,65,90,128,239, 240,272, 313,372, 414,416, 505,537, 607
F.	The construction of huge dams for the generation of hydroelectric power has often had unforeseen and undesirable consequences for the ecosystem of the region (e.g., resulted in the spread of schistosomiasis and microclimatic effects)	

G. Nuclear power plants release some radioactivity into the atmosphere and generate large amounts of radioactive material, whose disposal presents difficult problems. Currently, they also produce more waste heat than fossil fuel plants of the same size. The possibility of a serious accident releasing dangerous amounts of radioactivity into the environment cannot be ruled out	2,16,22,27,28,29, 41,58,80,84,90,91, 126,130,132,146, 165,173,182,183, 236,255,354,355, 356,357,358,359, 412,413,475,476, 553
VI. Energy Policy	35,50,57,114,137, 142,162,260,288, 317,326,340,391, 409,422,426,435, 474,493,500,502, 508,511,519,523, 525,526,569,584, 596,597,616
A. The consequences of the technoscientific revolution for national prosperity and viability can be seen clearly in the levels and kinds of energy inputs required in the industrialized nations	
B. Maintenance and continued development of energy resources is an element of national, state, and regional policies	13,188,241,264, 284,295,328,369, 388,427,452,481, 486,494,503,521, 547,559,578,580
1. Internal or domestic sources	393, 398, 490, 544
a. Discovery and inventory of fossil fuel resources, by geological surveys or industrial firms	296,346,431,520, 532, 560, 561
b. Subsidies, direct or indirect, of exploration and exploitation, or research and development (e.g., oil depletion allowances)	316
c. Regulation of allowable pollution production (e.g., prohibition of high-sulfur soft coal in many areas)	360, 437

d. Research to increase recovery of known resources (e.g., through nuclear explosions)	98, 116, 453, 538
2. External sources	
a. Trade and tariff agreements	
b. Supranational projects, such as electric power networks, multinational oil- and gas-producing companies	
c. Cooperative international development projects	26, 122, 212
d. Use of fuel embargoes as instruments of foreign policy	3
e. Impact of oil imports on Balance of Payments	66, 529
C. Transformation/transportation of energy	501
1. Analysis of the complex structure, public and private, needed to meet energy demands	
2. Effect of taxes and the regulation of prices on availability of energy (e.g., on interstate transmission of natural gas)	14, 109
3. Supervision of transportation, grading, safety precautions, etc. of fuels, as in interstate commerce	
4. Environmental consideration in the transportation of energy sources (e.g., the Trans-Alaska Pipeline and the oil tankers)	31, 33, 64, 77, 157, 184, 292, 428, 546
D. Policies for development of new forms or sources of energy or modification of old technologies	208, 211
1. Governmental impetus by law, subsidy, etc. given the development of atomic power (Atomic Energy Act)	194, 213, 226, 436 495
2. Government-subsidized hydroelectric projects (e.g., the Tennessee Valley Authority)	
3. Development of a rational and coherent policy for energy generally through new organizational structures (e.g., Federal Energy Office)	

3. Encouragement of new forms of energy conversion with mobility, minimal fuel consumption, and minimal environmental side effects (cf. Section II, B)	459, 460, 461, 462, 463, 574, 611
a. Solar power	291, 335, 394, 489, 606
b. Nuclear fusion	120, 178
c. Geothermal power	105, 515, 531
d. Tidal power	332
e. Hydrogen as fuel	88, 117, 127, 254
f. Fuel from wastes	149, 551
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4. Priorities in filling the "energy gap" for the intermediate term as proposed for "Project Independence"	15, 60, 162, 250
a. Increased exploration for oil and gas	521
b. Development of breeder-reactors	134, 163
c. Gasification of coal	160, 210, 534, 545
d. More economic extraction from oil shales and tar sands	59, 533, 541
5. Legal, economic, political, and social consequences of a shift of power sources for automobiles from internal combustion to electricity, steam, or other propellants	23, 143, 268, 286, 361, 366, 539
6. Reduced energy consumption as a policy alternative and the potential for energy conservation	21, 68, 93, 100, 101, 131, 308, 349, 377, 383, 415, 487, 509, 522, 555, 556, 571, 586, 609
VII. Forecasting Energy Sources: To Predict Where and How a New Source or Form of Energy (E.g., Atomic Fission) Will Influence the Future, We Must Know	198, 307, 314, 334, 337, 345, 375, 389, 440, 474, 510, 581
A. Its technological feasibility and availability	339, 351, 600
1. Restrictive factors affecting its use	
a. Geographical limitations	
b. Health and safety	
c. Extent of supply of basic materials	

   2. Technical advantages relative to other sources of energy

B. Its costs: direct and indirect
   1. Economic cost of its production
   2. Cost of previous sources becoming obsolete
   3. Effect on values and institutions
   4. Effect on the environment

C. Gains to be made through its use: technical, economic, and social

D. Relative costs and advantages of forms of energy already in use--economic, social, and ecological

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NOTE

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LEADING QUESTIONS

1. Why is modern society living off its "energy capital"? How long can this continue? What alternatives can society pursue and with what implications?

2. What are some of the social, political, and economic changes associated with adoption of new energy systems? What evidence does history provide?

3. Is there a semantic "trap" in the proposition that mechanized agriculture has increased the efficiency of the farm worker? What is the "catch"?

4. U.S. energy policy has been said to be concerned with insuring "an adequate supply of cheap energy, diverse in form and geographical source but drawn largely from domestic sources--produced in ways that cause no permanent damage to health or environment." (OECD Observer, June, 1967, p. 27). How valid does this statement appear to have been?

5. To what extent has control of energy been exploited as a means of political influence? What evidences are there of a politics of energy--domestically and internationally; in the past as well as the present?

6. It has been argued that successive levels of energy consumption have increased the interdependence of the components (individual and institutional) of societies. Has past "energy policy" in the United States reflected such a development? What seem to be some present trends? Are there countertrends?

7. Is it feasible to measure the technological level of a nation by the amount of energy it consumes? If energy-use represents progress, what international implications does this raise in view of the impending scarcity of energy resources?

8. Why has modern industrial society generally failed to make a major effort to obtain renewable, nonpolluting energy resources? What novel sources of energy are theoretically the most desirable, most promising?

9. Transportation is a vital link in the energy chain. Explore some of the problems of transporting the following: (1) oil; (2) natural gas; (3) coal; (4) nuclear fuel; and (5) liquified gas (propane, butane).

10. What environmental considerations are implicit in the formal statements of energy policy issued since 1970 by several national governments and international organizations?

TOPIC 06 ATMOSPHERIC SYSTEMS AND AIR QUALITY CONTROL

Man's use of air and water as essential elements in his life support system is involuntary and normally requires no implementing technology. His purposive use of these elements, however, involves the manipulation of natural systems and requires implementing technologies. The relatively simple technologies of pre-industrial societies (e.g., water wheels and windmills) utilized natural forces without seriously modifying them. Human impact upon natural systems began to assume threatening proportions with the growth of intensive large-scale agriculture and of cities. Atmospheric systems are less readily affected by human activities than are soil or water. Yet the quality of air may be seriously impaired in localities defined by human activities or geographical configuration. Thus in order to control the ambient air quality in any given area, the general patterns of atmospheric circulation and precipitation must be known. The science of atmospheric systems is an essential element in the foundation of public policy for air quality control.

Modifications of the atmosphere were largely inadvertent and incidental to man's economic activities. The deliberate burning of grasslands and forests released various compounds and particulates into the atmosphere. The global effects of these emissions prior to the very recent past, appear to have been negligible. But locally, the resulting turbidity of the atmosphere may have affected the weather and the health of plants and animals. Overgrazing and extensive disturbance of soils by cultivation and construction has released large amounts of dust into the atmosphere in semi-arid areas of the Earth. The atmospheric suspension of the dust is believed to have measurably increased the aridity of the climate in parts of India and Pakistan. Potentially more serious modifications of the atmosphere have accompanied the increased use of internal combustion engines burning fossil fuels. Automobiles, electric generating plants, and space heating have discharged massive amounts of CO_2, SO_2, hydrocarbons, and nitrogen oxides into the air, perceptibly affecting its properties and resulting in photo-chemical smog where predisposing conditions prevail. Attempts at intentional modifications of weather and climate are of more recent history and have primarily involved efforts to break up or contain severe storms, promote rainfall, and dissipate fog.

In the control of air quality there are almost no alternatives to the direct control of emissions. But emission control may be costly, inconvenient and difficult to administer. Efforts to cope with automobile exhaust emissions illustrate the difficulties. A preferable approach would be to develop technologies in which their is no discharge into the atmosphere or where the emissions are harmless. The single most significant advance in air quality control would be the practical development of a nonpolluting source of energy.

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LEADING QUESTIONS

1. What criteria have been used to establish air quality standards? What are the bases for these criteria? How can derived standards be enforced?

2. What are some of the main reasons companies have been slow to adopt pollution abatement technologies? Is there technology now available to remove all pollutants? If not, what pollutants are resistant, and why?

3. What evidence, if any, do we have to support the "greenhouse" effect of atmospheric carbon dioxide? Is there any evidence to support charges that S.S.T. exhausts would interfere with the Ozone layer?

4. Nuclear testing has dispersed radioactivity throughout the Northern Hemisphere. So far, the Southern Hemisphere has shown only small amounts. What atmospheric mechanisms cause this uneven fallout?

5. What percentage of air pollution in major cities is now produced by the automobile? What policies (excluding technical applications) could be exercised to lower this percentage?

6. What substances primarily contribute to pollution of the atmosphere? What are their sources? What are their individual and confined effects?

7. Significant climatic and ecological effects have been attributed to excessive quantities of dust in the atmosphere. Where has this dust originated? What are its known and hypothetical effects?

8. What are some of the arguments for having uniform air pollution laws, e.g. automobile emission standards? What alternatives might be considered?

9. What is the relationship between the amount of pollutants removed from industrial emissions and the cost of removing these pollutants? How does one determine, for example, what percentage of particulate matter it is economically feasible to remove?

10. To what extent has modification of weather been successfully undertaken? What legal and political problems are involved?

TOPIC 07 HYDRAULIC SYSTEMS AND WATER QUALITY CONTROL

Differences between the treatment of air and water in public policy and law result from the fact that although traditionally both have been viewed as free goods, only water can easily be appropriated for exclusive uses or channeled or transported over extended distances. Water systems flow across, through, and under the land and their management is inevitably related to the uses of the land. Because of the complexity of land-water interrelations there are many points at which human action may inadvertently disrupt natural hydraulic systems with resulting environmental damage. A major aspect of water quality control is the identification of these focal points of disruption and the application of measures to remove or mitigate the damage.

Deliberate modifications of hydraulic systems have been associated primarily with drainage and irrigation for agriculture, and with water supply and sewage disposal for cities. Large-scale hydraulic works for flood control and irrigation were developed in antiquity. The requirements for their management contributed, in the opinion of historian Karl Wittfogel (1957) to the rise of an authoritarian political system called "oriental despotism." Modern hydroelectric and waterway management systems require careful technical supervision and administrative control. The impoundments and other works necessary to their operation have often had far-reaching effects upon the human environment and upon human health and behavior.

Inadvertent modifications primarily affect water quality. The convenience of flowing water to carry off wastes has led to widespread degradation of water quality and the introduction of harmful substances, e.g., mercury, into food-chains and ecosystems. The control of water pollution has required elaborate technologies to "purify" water and to abate the discharge of contaminants. Advanced technologies, still largely experimental, include the continuous recycling of municipal water supply in essentially closed systems and the use of waste water effluent for fertilization and irrigation of agricultural land and for water table maintenance.

The greatest of all hydraulic systems and resources are the oceans. The vastness of the oceans, and the mysteries associated with them, have caused people to regard them as infinite and beyond human control. Today, we know that the oceans share the finite character of the Earth and that human negligence and mismanagement are imperishing their indispensible role in the planetary life-support system. A major research effort, the International Hydrological Decade, has been launched, (and extended) for the purpose of better understanding the three-quarters of the Earth's surface that is covered by water, and the resources and phenomena that it contains.

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LEADING QUESTIONS

1. What have been the prevailing legal arrangements in the United States with respect to water usage? What jurisdictional policy would be most conducive to rational uses of water?

2. What United States Federal laws govern the disposal of materials into navigable waters? Why have these laws not been more effective in preventing widespread pollution?

3. What significance does the leaching and runoff of farm fertilizers into rivers have for the future of agriculture? Is there any way to prevent this contamination?

4. What are some of the political and technical considerations that must be taken into consideration when implementing large scale water transportation projects such as the one now under construction from Northern California to Southern California? Is there any evidence that political expediency may override ecological and technical considerations?

5. Laws banning or controlling the amount of allowable phosphates in detergents vary widely from state to state. To what would you attribute this wide divergence of regulations?

6. Evaluate some alternative options for furnishing fresh water to cities. How feasible are proposals for making fresh water from sea water? For recycling urban water supply in a closed system?

7. What institutional arrangements have been developed to provide unified water management in politically divided river basins? Why has no single organizational pattern become generally accepted?

8. What are the principle contaminants of water supplies in industrial economies? Which are most dangerous? Which are most difficult to control?

9. What are the arguments for and against high-level dams, impounding water for irrigation, power and recreation in arid areas? What alternatives are available? What agencies administer water quality standards?

10. What role do the oceans play in world hydraulic systems and how are they affected by national environmental policy?

TOPIC 08 ECOSYSTEM MANAGEMENT AND LAND USE CONTROL

In most primitive and traditional societies, land has been viewed, along with air, fire, and water, as an element of nature. Modern industrial society has treated land primarily as a commodity. Modern education has tended to conceptualize land through the reductionist methods of the sciences. Until the ecological concepts of ecosystem, biome, and biosphere were developed, there was no comprehensive systematic way to describe the role of land in the planetary life-support system. Today, there is growing recognition of the interrelationship between land and all other aspects of the biosphere. In the interest of human well-being and ecological stability, it has become necessary to find ways to manage land in relation to its ecological limitations and capabilities.

Almost every environmental problem originates in the uses of land. Among the many classes of land-based environmental problems are air and water pollution, depletion of wildlife, erosion and deterioration of soils, and degradation of urban and rural settlements and landscapes. Among all other aspects of the environment, land presents a special difficulty for environmental policy. This is the economic status of land, almost everywhere a traditional and often major basis of private wealth. The difficulty of imposing environmental controls over land-use is especially great in countries with strong traditions of private ownership, such as the United States. But public ownership does not wholly obviate difficulties. In socialist countries, nationalized land is under the jurisdiction of various agencies of the state that may or may not pursue ecologically wise land-use policies. Very large areas of land in the United States are publically owned, but that fact alone does not guarantee ecological wisdom in policies regarding their use.

A cause of land abuse, and a handicap to its public control, is its treatment as a commodity, abstracted from the ecosystems of the Earth. Land is one of the basic elements in the planetary life-support system, at least for human and most forms of animal as well as plant life. Human ignorance or disregard of the ecological properties of land in soil characteristics, hydrology, substrata and use capabilities have impoverished large areas of the Earth. Misuse of land, often in violation of validated ecological principles, has led to the spread of deserts, and the waterlogging, laterization, erosion, and sterilization of soils. There is urgent need for worldwide classification of lands based on ecological as well as economic principles. Even more important, however, are ecologically sensitive land-use controls as major components of comprehensive environmental policies in each nation. A positive approach to land-use control is the management of the ecosystems that integrate all elements of the biosphere. Included in these ecosystems are those largely confined to fresh water bodies or to the oceans, for their genesis, survival, and vulnerability are directly related to living systems on the exposed land surface of the Earth.

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LEADING QUESTIONS

1. What are the elements of the ecosystems concept? How could the concept of ecosystems management be made operational in public life?

2. Cite some specific examples (3 to 5) of effective ecosystems management. What types of international, national, nongovernmental, or local arrangements would be required to manage the larger ecosystems of the world?

3. What are the principal deterrents to an ecosystems approach to environmental policy? What are some consequences of neglect of this approach?

4. What are some of the major land-use problems of industrial society that might have been made easier by effective ecosystems policies?

5. What are the principal legal provisions and doctrines governing the ownership and use of land in the United States? What are their merits and liabilities? How do these compare with provisions in other countries?

6. Where should responsibility be located for land-use policy decisions? Why? What initiatives, if any, should be reserved respectively for various levels of government, from local to international?

7. What was the task of the Public Land Law Review Commission? What were some of its principal recommendations? What influence has it had on the formulation of a public land use policy?

8. Considering the traditional American attitude toward private property, what alternatives are available to control the use of private land?

9. What has been the history of the United States in the use of public lands for mining, grazing, forestry, and recreation? Has this use always been in the public's best interest? Should "multiple-use" be generally required?

10. What were the principal objectives of the proposed (1973) Land Use Planning Act [S.268]? How do the provisions of this Act relate to the National Environmental Policy Act of 1969?

IV

PROBLEMS OF POLICY IMPLEMENTATION
ECONOMIC - JURIDICAL - INSTITUTIONAL

The nature and extent of all uses of the environment are limited by the parameters of natural systems and by the niche requirements of living species. "Use" must be understood to include the total protection or preservation of certain species and ecosystems. In these cases, "use" may mean deferred use in the conventional sense, or it may mean indefinite protection for aesthetic or for scientific purposes, as for example, "banks" of genetic material that might otherwise become extinct. Factors of population growth or decline, technological capabilities, and the economic practices of a society influence the priorities of the society in relation to its environment.

The very basic, primitive demands of man upon his environment have been determined through evolution and may be answered with the assistance of relatively simple, nontechnical social organization. But the more elaborate large-scale demands of civilized societies require complex economic and technical structures that draw heavily upon the natural environment. These demands, and the procedures through which their fulfillment is sought, grow out of the values, assumptions, objectives, and behaviors that characterize particular societies. In this respect, therefore, society mirrors itself in changes it makes in its natural environment. The welfare of a society depends upon its continuing ability to satisfy its needs from the natural environment. But social needs are both biologically and culturally defined. And whereas biological needs may be amenable to objective identification and measurement, cultural "needs" may be virtually infinite. They may also be conflicting because infinite "needs" cannot be fully answered in a finite world.

Competition thus characterizes man's use of his environment. Many of its valued aspects and resources are scarce, and their use must be allotted through some system of priorities. The processes of allocation take place through institutions whose structures to some extent influence the outcomes. Tacitly or explicitly the process is one of social choice and decision and is therefore, in its broadest sense, "political." The nature of the decisions regarding man's use of elements in his environment requires that they be organized or structured through formal arrangements that we call "institutional." The development of institutions suitable for achieving environmental quality objectives is a major task of national and international affairs.

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TOPIC 09 ECONOMIC ASPECTS OF ENVIRONMENTAL POLICIES

To the extent that the natural environment is used as a storehouse from which the material demands of men are met, the problems of man-environment relationships are broadly economic. These problems are also technological and ecological, but it is their economic aspect that has traditionally been the prior concern of governments. But the ultimate scope and content of economics have no universally accepted definition. There is, of course, a substantial body of theory and method that is generally recognized as belonging to the study of economics. Nevertheless, narrow-based and exclusive economic theories have been applied, sometimes with disastrous practical consequences for the environment. Conventional economic "wisdom" and "practical" judgements regarding taxation, credit, investment policy, and labor costs have had major although indirect environmental repercussions, which have often been harmful.

A major cause of "economic" damage to the environment is a tendency to abstract or isolate narrowly defined economic phenomena from the technical and natural systems with which they interrelate. The doctrine of "externalities" has become a familiar example of this tendency. Costs are said to be "externalized" when they are not factored into the market or monetary costs of a product or service but are thrust out into the environment as, for example, smoke from factories, tailings from mines, or trash and garbage from consumers' households. These residual products of economic activity are "leakages", as results of imperfect closure in technical systems and their projection into the environment results in the pollution or disruption of the natural systems affected. Economic analysis is now being employed to obtain a more adequate accounting of the total incidence of economic activities. A major problem in this analysis is the quantification or valuation of those environmental impacts of technology that have conventionally been considered to be outside the scope of economics. Aesthetic impacts, for example, may vary greatly in substance and intensity among individuals, and the significance of aggregated estimated costs may be difficult to determine. Many costs, moreover, relate to possible future effects, for example, to future opportunities foreclosed by present action. Are these costs fairly or correctly assessed against present demands upon the environment?

A new challenge to economic theory and practice has arisen with the prospect that the material growth of modern societies may come to an end during the next half century. Throughout modern history, economists and politicians have been able to assume the capability of the economy for indefinite growth. The prospect of an equilibrium or shrinking economy has not been seriously addressed by economic theory in terms applicable to practical affairs. It seems probable that the economics of environmental quality in the future will be closely related to the problems of an equilibrium economy.

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TOPIC 09 ECONOMIC ASPECTS OF ENVIRONMENTAL POLICIES

TOPICAL OUTLINE	REFERENCE KEY
I. Economic Concepts Basic to Environmental Policy Issues (cf. Basic Concepts: Cultural and Scientific, and Topics 03 and 08)	138, 159, 201, 207
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4. Dissenting economists and ecological economics	130,204
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b. Products replaced by mass production techniques--not repaired by labor intensive methods: "throwaway technology"	
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a. Economic growth	
b. Material growth	
c. Cyclical or renewal growth	
3. Developing an economic theory of dynamic equilibrium to match physical-ecological realities	

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LEADING QUESTIONS

1. What is meant by "externalizing" environmental costs? What are the major problems of internalizing these costs? What methods seem most feasible?

2. What have been the effects of allowing supply and demand market mechanisms to control the state of the environment? Have socialist countries fared substantially better under a "planned economy?"

3. Under the "invisible hand" theory of economics the public interest would benefit when each individual acted in his own self-interest. Why does this theory break down in relation to common property resources and the environment?

4. What economic problems might arise if a producer in one area is subjected to more rigid pollution abatement regulations than a similar producer in another area? What are the implications for regulation?

5. Automobile manufacturers have resisted production of "clean" auto engines on technical grounds. What evidence is there to support the argument that their resistance comes mainly from economic grounds?

6. What criteria are applied to determine feasibility or favorable cost-benefit ratios in environmental management and pollution control? What conflicts arise between economic and ecological tests of feasibility

7. How have the health costs of environmental pollution been estimated? What relationships are there between individual behavior (e.g., smoking) and environmental health costs? What are the economic implications?

8. What are the economic methods (and related technologies) for preventing environmental degradation and controlling pollution? How do economic incentives relate to "systems" approach?

9. Who pays the costs of environmental quality? Who should pay? How should costs be allocated?

10. How does the debate over economic growth relate to environmental problems and policies? What semantic problems are encountered in the "growth" issue? What are the economic implications of no growth, controlled growth, equilibrium tendencies and closed-system production cycles?

TOPIC 10 JURIDICAL ASPECTS OF ENVIRONMENTAL POLICIES

Any major change in the orientation of society implies change in the rules through which the affairs of the society are regulated. Any perfecting of the fit between technical and self-renewing natural systems implies change in law and legal procedures. Our growing understanding of man-environment interactions has led to the formulation of new rights, obligations, and objectives in relation to the environment. These legal changes occur not only among individuals and corporations, but also among governments and international organizations. One developing body of law concerns the rights of individuals against activities that impair the quality of their environment. Environmental damage affecting health or the value of property has traditionally been defensible in the courts of law. But concepts of what constitutes damage have been broadened as knowledge of environmental interactions has grown. Governments have begun to define and codify these rights and to establish objectives and criteria by which the environment-affecting activities of governmental and other agencies may be guided and controlled. The majority of this legislation relates to specific environmental problems, such as those connected with air and water quality, land use, contamination, noise, and visual blight. But nations have also begun to enact broader and more fundamental measures for environmental protection. The National Environmental Policy Act of the United States [PL 91-190, 1969] has been one of the more comprehensive statutes, specifying several aspects of national policy and providing implementing or action-forcing provisions through the requirement of environmental impact statements from federal agencies whenever they initiate activities significantly affecting the environment. Another area of development concerns the right of individuals to invoke judicial protection of environmental rights. In Anglo-American law this involves the doctrine of "standing to sue" and the closely related procedure of the class action suits in which a plaintiff may seek redress on behalf of the collective interests of a large group of individuals whose individual interests would not be sufficiently great to merit judicial redress under traditional doctrine.

There has been a much older body of law and legal procedure concerning the ownership and use of land, water and other natural resources. This legislation, however, has been inevitably affected by the environmental quality movement. Unfortunately much of it is poorly adopted to cope with the rapid and far-reaching developments through which misapplied technology may alter or destroy the character of an environment. Environmental law has therefore been invoked to modify laws governing land use, industrial activity, agriculture, and the exploitation and use of natural resources. Under the conditions now emerging in the world many of the tasks of environmental management have little historical precedent. New legal concepts and procedures will therefore continue to emerge as environmental policy develops.

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LEADING QUESTIONS

1. Does a nation, and specifically the United States, need a constitutional environmental bill of rights? How would these rights be defined? What should they include? What protections would such a measure add that are not now available through other legal provisions?

2. What are the traditional powers of government for protecting environmental quality? How effective have they been? What innovations have been prepared? What juridical problems do they raise?

3. How do the powers of United States federal, state and local government interrelate on environmental issues, specifically with respect to air and water quality standards, power plant siting, radioactive emissions, land use planning, eminent domain, and wildlife protection?

4. Some argue that the National Environmental Protection Act has been too effective. Is there any evidence to support this? Have there been proposals to amend the Act? To what degree and for what purpose?

5. The Calvert Cliffs court decision has been called "a landmark case." What was the case and in what respects has it been precedent-setting?

6. Compare the intent and provisions of the Michigan Environmental Protection Act of 1970 with public nuisance law. What constitutional issues might be raised by the role given the courts by the Act?

7. How do statutory law and common law differ and how does each apply to environmental law? To what extent does common law fail to protect environmental "rights" and why?

8. Aircraft noise litigation is perhaps one of the best documented areas of noise abatement suits. What have been some of the findings of the court concerning aircraft noise and property rights?

9. Why have environmental defense groups placed greater confidence in courts than in administrative agencies? What reasons have been given for the failure of Federal agencies to protect environmental rights or amenities?

10. To what extent has environmental litigation been used as a cover for unrelated controversies? What dangers would ulterior uses of environmental litigation present? Could there be any justification for this type of action? What remedies are there for abuse of legal procedures?

TOPIC 11 ADMINISTRATIVE ORGANIZATION AND PROCEDURE

Because the state of the environment was not an object of public policy, modern governments have not been structured to deal generally with environmental issues. Because the natural environment was perceived largely as a storehouse of resources for economic activity and a sink for the discharge of waste products, these functions tended to become determinants of administrative organization. For example, government agencies were established to assist or control forestry, mining, agriculture, and outdoor recreation. Public agencies were established early in history for purposes of flood control, irrigation, drainage, domestic water supply, road building, and canal building, among other forms of environment-shaping construction.

The conservation movement introduced some new forms of public organization, for example, national parks, agencies for the protection of wildlife and for the conservation of soil, fossil fuels, and minerals. But these agencies did not easily accommodate the objectives of the environmental quality movement. Even the conservation agencies were often more concerned with promoting use, production, and economic growth than with maintaining the integrity and self-renewing capabilities of natural systems. "Old line" natural resource and conservation agency personnel often saw in the rise of environmental and ecological policy issues a threat to their own importance and autonomy. Moreover, the tendency to identify environmental policy with the abatement of pollution limited the influence of environmental considerations in administrative organization generally.

First efforts at structural change merely added units for control of air and water pollution and solid waste management to existing structures. The flow of pollutants through all media suggested, however, the desirability of consolidated agencies for pollution control; the United States Environmental Protection Agency was organized in 1970 on the basis of this consideration. The adoption of national environmental policies led to the establishment of coordinative structures at highest administrative levels. For example, ministries for the environment were established in France and the United Kingdom, the Council for Environmental Quality was placed in the Executive Office of the President of the United States, and an Environment Protection Board was established as a high-level coordinative body in its government in Sweden. Similar tendencies to create high-level policy formulating and coordinative bodies have appeared at various subnational levels of government (e.g., states, provinces, municipalities, and intergovernmental agencies). Administrative procedures have also been affected, scientific information and problem-solving playing a relatively larger role than in most of traditional public administration. Two unresolved problems of policy and structure are: (1) how should governmental and nongovernmental organizations interrelate to administer environmental control measures, and (2) how should the Nation organize to reconstruct and restore degraded environments?

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LEADING QUESTIONS

1. Within the United States what have been some of the institutional changes within various state governments to cope with the environmental crisis?

2. What is the mission of the Environmental Protection Agency? How was it established? What is the rationale for its structure?

3. It has been charged that the environmental crisis has brought about an "institutional crisis." What evidence supports this charge? Would the reverse proposition be true?

4. What proposals have been made for reorganizing the Executive Branch of the United States government to more effectively coordinate policies for resources, environment, and energy? How do they compare with administrative arrangements in other industrial countries?

5. What is meant by the statement that "the Federal government is too far removed from environmental problems to act; it can only react." Is this true? If so, what remedies, if any, are suggested?

6. What problems are brought about by agencies, like the Atomic Energy Commission, charged with both promoting an economic activity and regulating it in the private sector? What other agencies share this situation?

7. Governmental environmental policy has tended generally to be prohibitory or regulatory rather than positive or constructive? Why? Is this true equally of socialist and capitalist regimes?

8. What assistance is now available to an administrator to help guide his environment-related decisions? To what extent is this assistance being used?

9. What are some of the organizational arrangements through which other countries administer their environmental policies? Are any common patterns or principles in evidence?

10. Is it true that in environmental administration: "The decision to do nothing is often more powerful and far-reaching than a decision to do something." What is the evidence? What examples illustrate the point?

TOPIC 12 INTERNATIONAL INSTITUTIONS AND AGREEMENTS

The state of the world environment became an object of international policy in the late nineteen sixties, most notably in the Biosphere Conference of 1968 and in action by the General Assembly of the United Nations calling for a Conference on the Human Environment. The Conference, which convened in Stockholm on June 5, 1972, symbolized the official emergence of the environment as an object of worldwide international concern. Among the positive accomplishments of the Conference were the endorsements of a series of treaties dealing with various aspects of environmental protection, an action plan of 109 sets of recommendations, new United Nations machinery in an Environment Secretariat headed by an Executive Director, a Governing Council of national representatives, a coordinative board of environment related administrators in the United Nations Specialized Agencies, a world environment fund, and mechanisms for monitoring the state of the global environment.

Prior agreements already existed for particular environmental problems, especially of regional or local character. The protection of fish and wildlife and the management of international waterways were the most common objects of international institutional arrangements. Examples are the several international fisheries commissions, the treaty arrangements protecting the Pribilof Fur Seals, the Rhine and Danube River Commissions and the International Joint Commission of Canada and the United States for cooperative action relating to boundary waters. Several world conferences were sponsored by the United Nations or by Specialized Agencies beginning in 1949 with the Scientific Conference on the Conservation and Utilization of Resources. Subsequent meetings included the International Technical Conference on the Conservation of the Living Resources of the Sea, 1955, the United Nations Conference on New Sources of Energy, 1961, the Conference on the Application of Science and Technology for the Benefit of Less Developed Areas, 1963, the UNESCO Intergovernmental Conference of Experts on the Scientific Basis for Rational Use and Conservation of the Resources of the Biosphere, 1968, and the Food and Agricultural Organization Technical Conference on Marine Pollution and Its Effects on Living Resources and Fishing, 1970.

The modification or development of international law and policy concerning environmental issues is complicated by differing stages of development among nations and by the rapid emergence of new and powerful technologies whose effects cannot easily be forecast. Differences between the more and less developed nations were sharply drawn at the United Nations Conference on the Human Environment. These differences have been compounded by the growth of multinational corporations and by global technologies such as Earth-orbiting satellites. International environmental law and institutional arrangements may be important areas of innovations for many years to come. Meanwhile a new international commitment to global protection has been formalized in the establishment of the United Nations Environment Program [UNEP] with headquarters in Nairobi, Kenya and a fifty-eight member Governing Council which met for the first time in June, 1973.

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- f. North American Council on Fisheries Investigations (1920-1938) and International Commission for the Northwest Atlantic Fisheries (1949)
- g. West Pacific Fisheries Commission (1956)
- h. Northeast Atlantic Fisheries Commission

3. Food and Agriculture Organization sponsorship of regional councils for development of fisheries and the exploration of the sea
   - a. Indo-Pacific Fisheries Council (1948)
   - b. General Fisheries Council for the Mediterranean (1952)
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LEADING QUESTIONS

1. What are the principal policy issues in international environmental affairs today? What other issues may arise in the future?

2. Describe the various types of international efforts to conserve the living resources of the sea? To what extent have these efforts succeeded?

3. Outline the principal results of the 1972 United Nations Conference on the Human Environment? How do these compare with early international efforts on behalf of environmental protection?

4. What proposals have been made regarding international control of the high seas and deep-seabed?

5. What political issues have arisen between the so-called "developed" and "developing" countries with respect to environmental policy and administration? Specifically what is meant by "compensation" and "additionality?"

6. What principles already established as international law might serve as a basis for international environmental policy?

7. What problems arise in connection with proposals to monitor changes in the global environment? What proposals have been made, and by whom?

8. Identify the principal obstacles to international agreements on environmental affairs. How does the doctrine of sovereignty complicate relationships?

9. How do activities of multinational corporations affect efforts to protect the environment?

10. In what ways, and to what extent, may international agreements and institutional arrangements reinforce and assist national efforts for environmental protection?